Submitted to the SPIE conference on Astronomical Telescopes and Instrumentation, AS22, Millimeter and Submillimeter Detectors, 22-28 August, 2002

(Invited paper)

Local Oscillator Sources

Imran Mehdi

Jet Propulsion Laboratory, M/S 168-314, 4800 Oak Grove Drive, Pasadena CA 91109
Email: imran@merlin.jpl.nasa.gov

Abstract

Most of the currently operational radio telescopes, both space borne and ground based, employ local oscillator sources based on Gunn diodes followed by whisker contacted Schottky varactor multipliers. However, enough technical progress has been made on a number of fronts to conclude that the next generation of radio telescopes that become operational into the new Millennium will have drastically different Local Oscillator generation architecture. MMIC Power Amplifiers with impressive gain in the K to W band have enabled one to construct signal synthesizers at lower frequencies which can then be actively multiplied to provide frequency agile low power signals up to 100 GHz. These signals are then amplified (>100 mW) to enable efficient pumping of balanced multipliers. Input power can be further enhanced by power combining. A 800 GHz, three stage multiplier chain, implemented this way has demonstrated a peak output power of 1 mW.

The second advancement concerns the Schottky diode varactor. Planar Schottky diode varactors have now been demonstrated up to 1500 GHz and it can be assumed that most of the future multiplier chains will be based on planar Schottky diodes. The ability of producing planar GaAs diode chips deep into the THz range with submicron dimensions has opened up a wide range of design space which can be utilized to improve the efficiency, bandwidth and power handling ability of the multipliers.

A third technical breath through has been the demonstration of photonic based LO sources. These sources, though not quite fully implement-able in robust solid-state components, offer a number of advantages over their electronic counterparts.

This talk will present an overview of the current technologies that are available for implementing local oscillator sources for heterodyne receivers. Progress made to date on various components that make up the sources will be discussed in some detail. Outstanding issues and concerns regarding practical implementation of these new technologies will be discussed.